

MOUND LABORATORY'S AIR SURVEILLANCE SYSTEM


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ABSTRACT

A comprehensive air surveillance system was developed. The system includes surveillance of the source, transport conditions, and concentration at the receptor sites. An unusual aspect of the system is the implementation of off-site sampling programs through local governmental agencies. Background levels of radioactivity are routinely determined.

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Mound Laboratory, operated by Monsanto Research Corporation, is situated on 180 acres of land in Miamisburg, Ohio, approximately 10 miles southwest of Dayton. The Laboratory was built in 1948 as the first permanent facility for the AEC as an outgrowth of the work done by Monsanto for the Manhattan Engineering District. Its mission currently includes research, development, engineering, and production of components for the AEC weapons program; research, development, and production of explosive materials; separation, purification, and sale of stable isotopes of the noble gases; and development, design, and fabrication of radioisotopic heat sources for medical application and space exploration. Radionuclides currently being worked with include plutonium-238, polonium-210, and tritium.

Historically, environmental monitoring at Mound began with an informal monitoring study for radioactive materials prior to the construction of the Laboratory in 1948.

Since operations began in 1949, an on-going program has complemented the monitoring data from the preliminary study. This continuing program, initiated in 1949, met the requirements of existing standards. Its scope was sufficient to demonstrate compliance of operation well within AEC standards. In the late

1960's, however, it became evident that demonstrating compliance well within standards would not be sufficient.

In the climate of increased environmental concern prevalent at that time, it became obvious that a nuclear site such as Mound must document all releases and also measure, with the greatest care and precision available, their effect on the environment. Mound matched this heightened emphasis on documentation and precision with the development of the Air Surveillance System. The objective of this system is to provide technical excellence as well as public acceptance of the results of the system.

The system provides for surveillance of the source by continuous sampling and monitoring of stack emissions. The transport conditions are continuously monitored at an on-site meteorological station. Wind speed and direction are measured 160 ft above ground level by tower-mounted instruments. Temperatures are also measured at three elevations to aid in determining atmospheric stability. Finally, concentration at the receptor site is determined by continuous air sampling followed by specific radionuclide analysis. Seven continuous air sampling stations are located on the basis of atmospheric diffusion calculations. The basic equation used for the calculations is that for diffusion from a continuous point source found in Turner's "Workbook of Atmospheric Dispersion Estimates."

These seven sampling locations are all within one mile of the Laboratory at the predicted maximum concentration in the environment. Thirteen sampling stations are located in or near adjacent population centers ranging from Vandalia, which is 21 miles to the north, to Middletown which is 10 miles to the south. An additional sampling station is located approximately 28 miles from the Laboratory in the least prevailing wind direction. This site should receive no measurable contribution from Mound operations and serves as a background sample for comparison purposes. These sampling sites are shown in Figure 1.

In addition to the 21 off-site continuous air sampling stations, five continuous air sampling stations are located at or near the site boundary. The continuous sampling is augmented by use of a mobile laboratory capable of mobile sampling and "in the field" analytical support. It is important to emphasize that a mobile laboratory is a desirable component of an overall air surveillance system. It is used routinely to collect environmental samples and is available for use in the event of an accidental release. This mobile laboratory can be made available for use in support of off-site radiological emergency assistance teams. At the present time it is being modified so that it can be air-lifted to any part of the world.

Several types of samples are collected at the continuous air sampling locations. Of particular interest is the continuous high volume particulate sample. This sample is collected on a 200-mm diameter Microsorban disk by means of a high volume sampler at a rate of 40 ft³/min (1 x 10⁶ cm³/min). The Microsorban disk is changed weekly, which represents a sample of approximately 10,000 m³ of air. A monthly composite sample is made up from the weekly samples, and is analyzed specifically for plutonium-238. The analysis includes the use of plutonium-236 as an internal standard in conjunction with alpha pulse height analysis.

The minimum detection limit of this system is 0.36 aCi/m³ for plutonium-238. The annual averages obtained for 1973 range from 1.9 to 57 aCi/m³. The results reported for 1972 by the AEC Health and Safety Laboratory from their fallout network at approximately the same latitude as Mound Laboratory range from 2.0 to 6.5 aCi/m³.

The final component of the system is a small computer which will collect data, reduce it, modify the atmospheric diffusion equations, and arrive at an atmospheric diffusion model for Mound Laboratory. The components of the air surveillance system are shown conceptually in Figure 2.

An unusual aspect of the system is the implementation of the off-site sampling portion. In order to keep from raising public concern over Mound Laboratory operations by the sudden appearance of a number of air sampling stations, a mutual agreement with the local public health agency responsible for monitoring air pollutants was established. The agreement called for this agency (the Montgomery County Combined General Health District) to install, operate, and maintain the off-site network of air sampling stations. The agency collects samples weekly and turns them over to the Laboratory for the specific radionuclide analyses. This arrangement has played a large role in achieving the second objective of the system, that of public acceptance of the results of the system and added credibility to the monitoring program by the very fact that an open working relationship with a recognized public health agency exists.

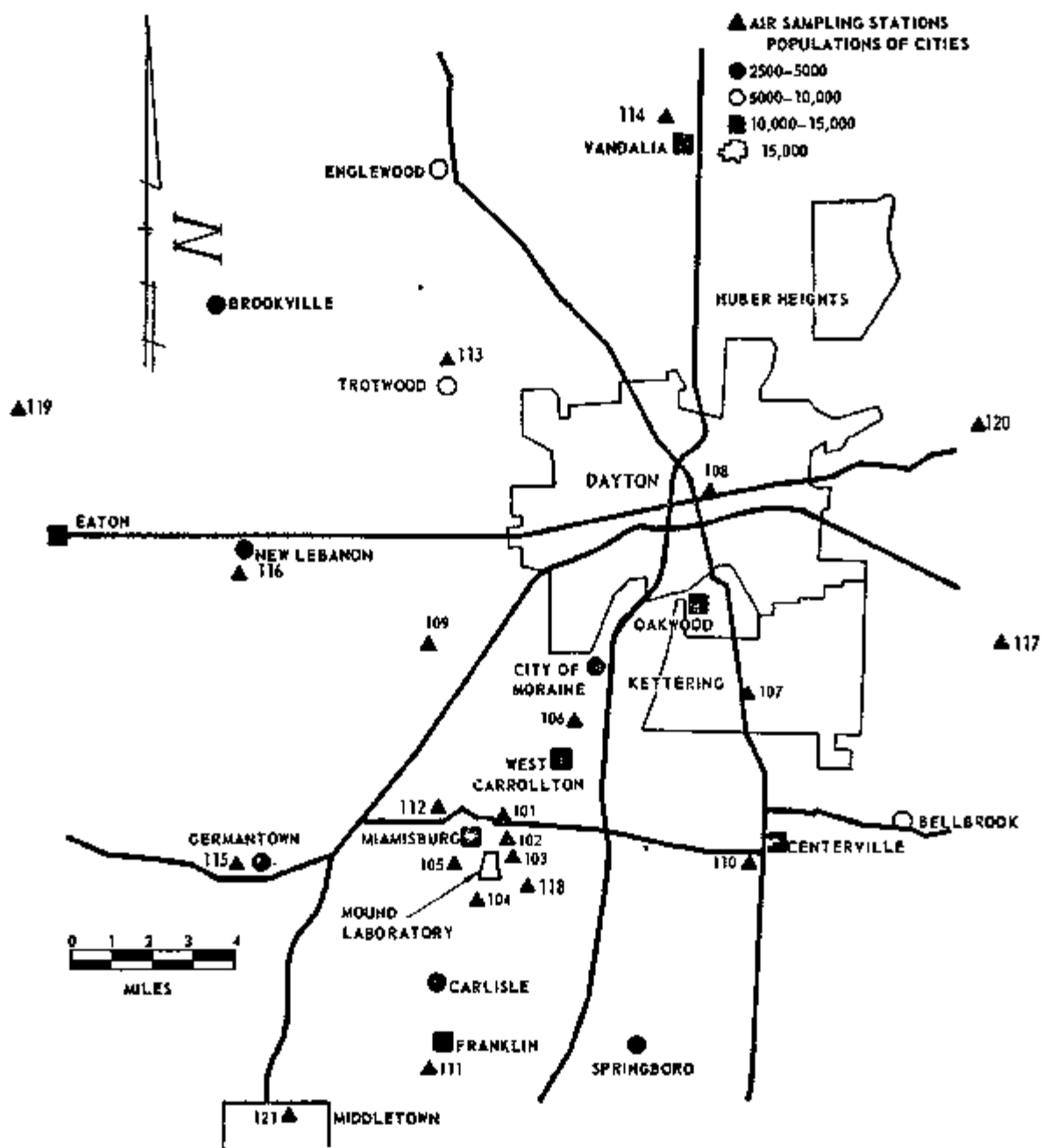


FIGURE 1 - Air sampling sites

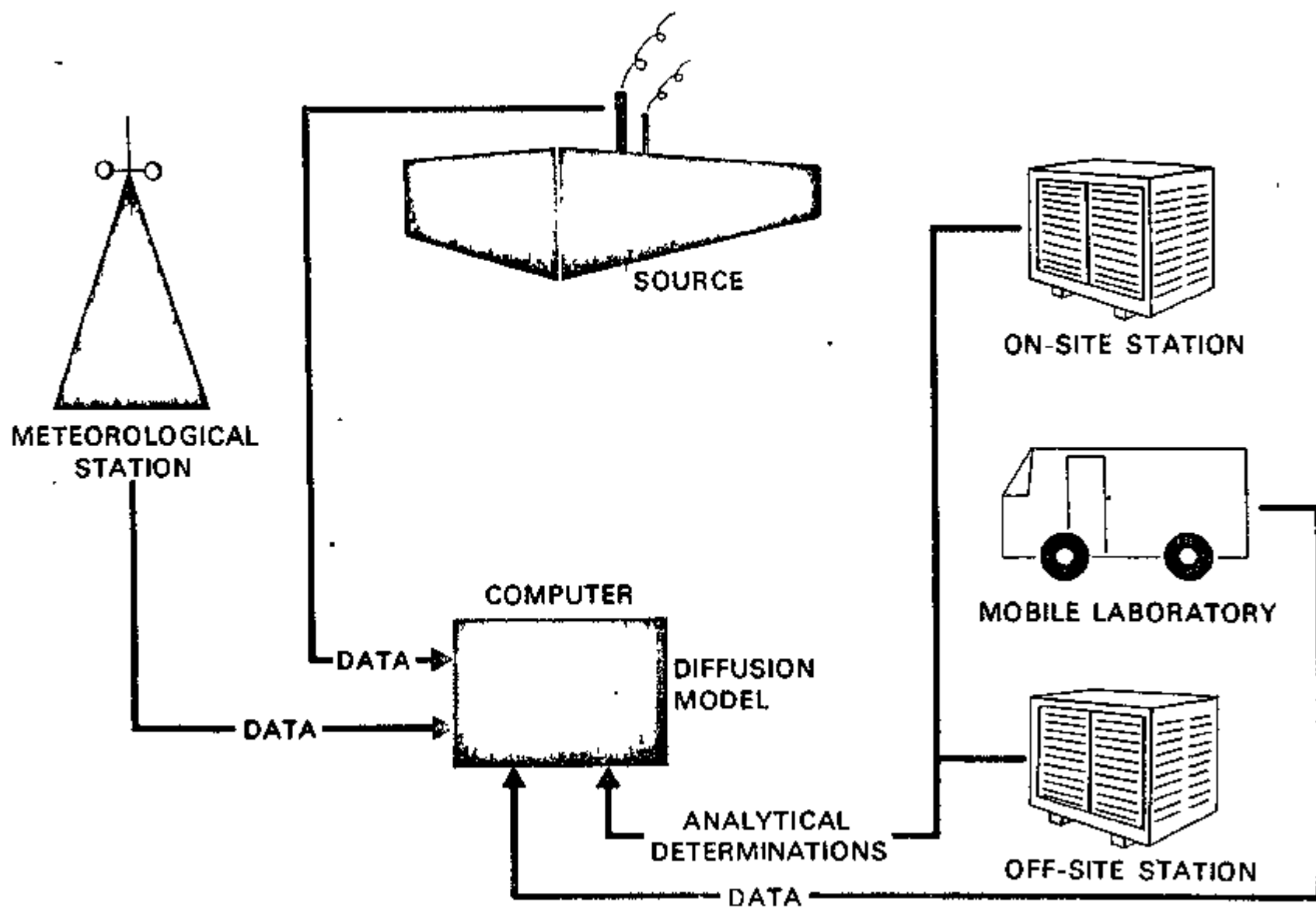


FIGURE 2 - Air surveillance system